STABLE PARTICLE METHODS BASED ON LAGRANGIAN KERNELS

T. Rabczuk[a] and **T. Belytschko**[b]

[a]Department of Mechanical Engineering
Northwestern University
Evanston, Illinois 60208-3111
t-rabczuk@northwestern.edu

[b]Department of Mechanical Engineering
Northwestern University
Evanston, Illinois 60208-3111
tedbelytschko@northwestern.edu

Particle methods and some applications to solid mechanics are described. First the SPH approximation is resumed. A Krongauz Belytschko correction of the derivatives of the shape functions is developed for large deformation problems. The discrete equations are obtained by a collocation method and as Galerkin method like in EFG. The governing equations are discretized by a Petrov Galerkin procedure with Shepard functions as test functions and the Krongauz Belytschko corrected derivatives as trial functions. Different integration schemes like a nodal integration, a nodal integration with stress points and a cell integration, which is frequently used in the EFG method, are considered. A Lagrangian and an Eulerian kernel is compared. It is shown that the Lagrangian kernel is stable in tension and replicates results for fracture and shear bands accurately. A method to switch from a continuum mechanic based constitutive model to a discrete crack model for materials with strain softening is proposed. It is applied to concrete under quasi static loading and compared to experimental results.